Assessment Schedule – 2017

Mathematics and Statistics:

Apply probability methods in solving problems (91267)

Evidence Statement

Q1	Expected Coverage	Achievement(u)	Merit(r)	Excellence(t)
(a)(i)	$p = \dfrac{222}{507} = 0.4379$	Proportion correct.		
(ii)	$p = \dfrac{507}{2500} = 0.2028$ Expected No. $= 0.2028 \times 585000$ $= 118\ 638$	Expected number correct.		
(iii)	Risk of female obesity $= \dfrac{285}{1295} = 0.220$ Risk of male obesity $= \dfrac{222}{1205} = 0.184$ Relative risk $= \dfrac{0.220}{0.184} = 1.1946$ As this is not **over** 20% more, the article is **not** correct.	One risk correct.	Relative risk correct.	T1: Comparison with 20% but conclusion ignores strict inequality or rounds excessively T2: Comparison with 20% and correct conclusion based on strict inequality
(b)(i)	<table><tr><td></td><td>Smoker</td><td>Non-smoker</td><td>Total</td></tr><tr><td>Male</td><td>53</td><td>169</td><td>222</td></tr><tr><td>Female</td><td>50</td><td>235</td><td>285</td></tr><tr><td>Total</td><td>103</td><td>404</td><td>507</td></tr></table> $\dfrac{235}{507} = 0.4635$	Number of female non-smokers found (235).	Proportion correct.	
(ii)	Risk of smoker obese $= \dfrac{103}{420} = 0.245$ Risk of non-smoker obese $= \dfrac{404}{2080} = 0.194$ Claim is justified since there is a greater risk of being obese if a smoker.	One risk correct.	Clear conclusion using correct risks.	

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No relevant evidence.	A valid attempt at one question.	1 of u	2 of u	3 of u	1 of r	2 of r	1 of T1	1 of T2

Q2	Expected Coverage	Achievement(u)	Merit(r)	Excellence(t)
(a)(i)	P = 0.65 × 0.86 = 0.559	Probability correct.		
(ii)	P = 0.35 × 0.4 = 0.14 Accept $P = 0.35 \times \dfrac{4}{15} = 0.0933$	Probability correct.		
(iii)	Consider 1000 ewes that lamb. Nr of lambs from single birth that survive =1000 × 0.65 × 0.86 = 559 Nr of lambs from twin births … Where both survive = 1000 × 0.35 × 0.4 × 2 = 280** Where one survives = 1000 × 0.35 × 0.4 × 1 = 140 P(lamb from single | surviving lamb) $= \dfrac{0.559}{559+420} = \dfrac{559}{979} = 0.571$	Correct numerator of 559 or 0.559 used in a fraction		$\dfrac{559}{559+700x+y}$ $x = y = 0.4$ p = 0.571 $x = \dfrac{4}{15}, y = \dfrac{8}{15}$ p = 0.599 Accept $\dfrac{559}{839} = 0.6663$

(iv)	Consider 1000 ewes:
	Nr producing 1 live lamb
	= 1000 × (0.85 × 0.65 × 0.86 + 0.85 × 0.35 × 0.4)
	= 1000 × (0.475 + 0.119) = 594 lambs
	Nr producing 2 live lambs
	=1000 × (0.85 × 0.35 × 0.4) = 119
	    → 119 × 2 = 238 lambs**
	Lambing percentage = $\dfrac{594+238}{1000} = 83.2\%$
	(accept decimal)
		0.85 used correctly, such as
		0.85 × 0.65 × 0.86
		=0.4752
			Consistent answer not accounting for 2 twin lambs, giving 71.3%	Solution correct:
				85(0.559 + 0.7x
				    +0.35y)
				x = y = 0.4 :
				p = 83.2%
				$x = \dfrac{4}{15}, y = \dfrac{8}{15}$
				p = 79.3%

(b)	$p = \dfrac{3}{5} \times 0.06 \times 0.88 = 0.032$	0.06 × 0.88 correct.	Probability correct.	

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No relevant evidence.	A valid attempt at one question.	1 of u	2 of u	3 of u	1 of r	2 of r	1 of t	2 of t

Q3	Expected Coverage	Achievement(u)	Merit(r)	Excellence(t)
(a)(i)	$P(0 < Z < 1.154) = 0.3757$	Probability correct.		
(ii)	$P(Z < z) = 0.1 \Longrightarrow z = -1.28$ to -1.282 $\dfrac{x - 4125}{65} = -1.28$ to -1.282 $x = 4125 - 1.281 \times 65$ $= 4041.67, 4041.735$ or 4041.8 g $= 4042$ g (4sf)	$z = -1.284$ (-1.28) correct.	Correct answer. Accept CAO.	
(iii)	Tables: $P(0<Z<z) = 0.1 \Longrightarrow z = 0.253(3471)$ $\dfrac{4000 - 3975}{\sigma} = 0.253(3471)$ * $\sigma = \dfrac{4000 - 3975}{0.253} = 98.814\,(98.6816)\,(3dp)\,g$ OR Record of "guess and check" giving $\sigma = 98.67885$	$z = 0.253$ correct OR σ=99	Expression (*) set up OR Consistent solution based on incorrect z OR Working and $\sigma = 98.7$	Correct answer with working. OR Working and $\sigma = 98.68$
(iv)	$P(\text{Weight} > 4025)$ $= P(Z > -0.2976) = 0.617$ $P(\text{Both} > 4025) = (0.617)^2 = 0.381$	p = 0.617 correct OR consistent p^2	Probability correct.	
(b)(i)	$p = \dfrac{35}{50} = 0.7$	Proportion correct.		

(ii)	Comparison of the distributions given below for the normal (expected) distribution vs sample distribution, resp. Numerical justification given in [ ].
	Possible valid comments about differences:
	Shape:
	  1. Symmetrical vs not symmetrical
	  2. Averages all same vs not all same [4050 vs various]
	  3. Unimodal vs bimodal [4050/both "3950" and "4050"]
	Centre:
	  4. Medians [4050 vs <u>over</u> 4050] (do not accept modes)
	Spread:
	  5. Range [550 vs 350], or estimates of SD or IQR (with reasoning)
	Possible valid comments about similarities:
	Centre:
	  6. Means [both 4050]
	Probability:
	  7. $P(w > 4000)$ [0.724 vs 0.7]
		Two valid comparative comments about different aspects of shape, centre and spread.	Three valid comparative comments about different aspects of shape, centre and spread with numerical justification for at least two comments.	Four valid comparative comments about different aspects of shape, centre and spread with numerical justification for at least three comments.

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Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 13	14 – 19	20 – 24